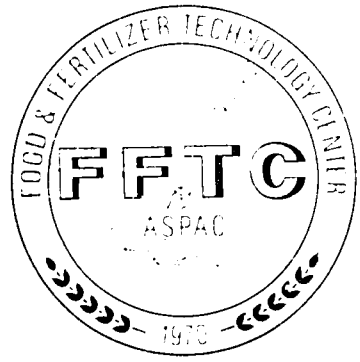

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THE DEVELOPMENT OF COMMERCIAL POULTRY PRODUCTION

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FOREWORD

Over the last three or four decades, poultry production in Korea and Taiwan has developed from the backyard raising of very small flocks as a sideline activity to the modern intensive production of several thousand birds on specialized poultry farms. Total production has risen rapidly to meet the growing demand for poultry products. However at the same time the number of poultry farms has fallen, as numerous small-scale enterprises have been replaced by fewer and larger ones.

The two papers in this bulletin describe this development, and discuss how economies of scale have been achieved by farms which are seldom much more than one hectare in size. In Korea, a cooperative farming program is combining groups of individual farms under common management, with a marked increase in efficiency. Integrated production is also becoming more common. Although chickens are the most common poultry in Taiwan, duck production is also a major industry. Not only the eggs and meat, but also the down, are of considerable economic importance. The main problems facing poultry producers are outlined, and some policies suggested which would help them in their production and marketing.

Both the papers published in this Bulletin were originally presented at an international workshop on "*Development Approaches for Livestock Based Rural Enterprises*", held in the Philippines in May 1994. The workshop was co-sponsored by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), and the Department of Agriculture of the Philippines. The authors are all eminent livestock specialists who have played a leading role in developing the livestock production of their own countries. We welcome this opportunity to share their experience and expertise with others involved in livestock production in the Asian and Pacific region.

THE DEVELOPMENT OF COMMERCIAL POULTRY PRODUCTION

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(Chinese Abstract)

摘　　要

在過去幾十年，韓國的家禽事業發展十分迅速。自1960年以來，肉與雞蛋的消費量顯著增加。肉雞及蛋雞商業化的生產造成大農場及自動化的生產而減少生產的成本。

蛋雞生產，自1989年以後，農民開始建立合作農場而成功地減少生產成本。在肉雞生產，綜合經營減少生產成本，也穩定肉的供應以及改善衛生。

(Japanese Abstract)

摘　　要

韓国の家禽産業は過去二、三十年の間に急速に成長した。それにともない1960年以来、肉、卵の消費も大きく拡大した。産卵鶏や肉用鶏の飼育は、大農場で行われ、生産費を削減するため自動化されている。

産卵鶏の養鶏では1989年からは農家の協業化が始まり生産費の削減に成功している。肉用鶏の場合は総合化 (Integration) がコストダウンに貢献している。総合化は同時に鶏肉の安定供給と衛生条件の向上にも役立っている。

(Korean Abstract)

초　　록

한국의 가금산업은 지난 수십년에 걸쳐 매우 빠른 성장을 해왔고 1960년대 이래 육류및 계란의 소비 역시 급격히 늘었다. 양계와 육계 모두 상업화가 진전되고 있고 생산비절감을 위한 자동화도 꾸준히 진행되고 있다. 특히 계란생산은 1989년에 협동농장이 설립되기 시작하는 등 발전이 있었고 육계는 농장간 통합화되면서 수급및 가격안정 그리고 위생처리의 개선등이 이루어 지고 있다.

THE DEVELOPMENT OF COMMERCIAL POULTRY PRODUCTION

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ABSTRACT

The Korean poultry industry has developed rapidly over the past few decades. Since 1960, the consumption of meat and eggs has expanded tremendously. The commercial production of layers and broilers has resulted in bigger farms and automation to reduce production costs.

In layer production, farmers began to establish cooperative farms after 1989, and succeeded in reducing costs. In broiler production, integration helped to reduce costs. Integration also helped to stabilize the supply of meat, and improve sanitation.

INTRODUCTION

The climate of Korea is a combination of the continental climate of central Asia and a marine tropical monsoon climate. The interaction of both weather patterns results in four distinct seasons. From late November to early March, the monsoon brings cold continental air and January is normally the coldest month of the year. During summer, warm and moist air originating from the tropical zone of the East China Sea, dominates the weather. From late June to July is the rainy season. During that time, the livestock industry has problem of hot temperatures and high humidity.

Consumption of meat and eggs in Korea has increased rapidly since 1960 (Table 1). In 1965, the consumption of meat and the number of eggs per capita were 3.4 kg and 30, respectively, compared to 23.9 kg and 183 eggs in 1992.

DEVELOPMENT OF THE POULTRY INDUSTRY

Chickens have been raised for at least 2,000 years in Korea, but until 1900, they were raised in back yards for egg production.

From 1901-1940, breeds such as Barred Plymouth Rock, Nagoya Cochin and Single Comb White Leghorns were introduced from Japan. These imported breeds were reproduced by artificial hatching.

Between 1940 and 1960, as a result of World War II and the Korean War, the total number of chickens fell sharply. When peace returned, Single Comb White Leghorns, New Hampshires and Rhode Island Reds were introduced as part of the post-war rehabilitation programs. The period 1960-1980 was the time that commercial poultry farming in Korea developed and stabilized. The government strongly promoted the raising of small animals such as poultry and swine to meet the rising demand for animal products. The commercial broiler industry began after 1970.

From 1980 to the present day, poultry production has modernized, and there has been a change from full-time poultry farms to poultry factories. Specialization in hatching, rearing, egg grading and packing has taken place, and vertically and horizontally integrated

Keywords: broilers, cooperatives, costs, integration, Korea, layers, poultry marketing, poultry production

Table 1. Consumption of meat and eggs by year

Year	Beef		Pork		Chicken meat		Chicken eggs	
	Total (mt)	per capita (kg)	Total (mt)	Per capita (kg)	Total (mt)	Per capita (kg)	Total (million)	Per capita
1965	27	1.0	56	1.9	14	0.5	856	30
1970	37	1.2	83	2.6	45	1.4	2,456	77
1975	30	2.0	99	2.8	56	1.6	2,896	83
1980	100	2.6	242	6.3	91	2.4	4,543	119
1985	120	2.9	346	8.4	126	3.1	5,390	131
1990	177	4.1	505	11.8	172	4.0	7,151	167
1992	227	5.2	585	13.4	231	5.3	8,042	183

Source: Ministry of Agriculture, Forestry and Fisheries 1992

systems have been established. Recently, pollution problems related to livestock, and a labor shortage as workers refused work with the '3Ds' (dirty, dangerous, difficult), has forced the automation of facilities.

LAYER INDUSTRY

Of all types of animal production, it is poultry, and particularly layers, which show the fastest growth rate. After the Japanese period, the Livestock Division of the Agricultural Experiment Station in Suwon took charge of the improvement and distribution of breeding chickens. Unfortunately, the Korean war destroyed all the breeding stock. After the war, considerable amounts of breeding stock and eggs were provided by several foreign aid organizations. Thus, the number of chickens greatly increased even though management techniques were still at an early stage of development.

After 1963, Korea began to import commercial crosses and inbred breeders which provided layers with excellent performance. The success of the First Five-Year Economic Development Plan raised the GNP markedly, resulting in an increased demand for poultry products.

Up to 1960, chickens were reared in open barns located in the corner of the farmyard. Production in closed barns began in the early 1960's, when poultry farming began to be a full-time operation. The battery cage system was introduced into Korea in the mid 1960s. The first windowless barns were built in 1964 by several poultry farmers, but they failed because of the high cost of building and operating them.

The total number of poultry farms in 1955 was 1.12 million raising a total of 8.92 million chickens (Table 2). At that time, the average number of birds per farm was only 7.9. Thereafter, the number of poultry farms kept increasing, up to 1.37 million in 1963. However, the number decreased to 1.17 million in 1970 and again to 1.09 million in 1975. At the same time, the number of chickens increased rapidly. The number of chickens per farm increased to 7.9 birds in 1955, 9.0 birds in 1965, and 19.1 birds in 1975.

After 1980, due to stagnant demand and over-production, small poultry farms gradually disappeared. The number of farms by flock size is shown in Table 3. The popular size of poultry farm in the early 1980's was around 5,000 birds, because this was the optimum size managed by a farm family without automation. Eventually, competition to reduce production costs brought automation and bigger houses. The number of poultry farms raising more than 50,000 birds has increased almost four times over the past ten years. The total number of chickens raised on such farms also increased, from 3.13 million in 1981 to 12.91 million in 1992.

The high production costs on small

Table 2. Number and size of chicken farms in Korea, 1955-1975

Year	No. of farms x 1000	No. of birds x 1000	No. of birds per farm
1955	1,123	8,923	7.9
1960	1,210	12,030	9.9
1965	1,320	11,892	9.0
1970	1,178	23,476	19.9
1975	1,094	20,938	19.1

Table 3. Number of layer farms according to size of flock

	1981		1985		1990		1992	
Size of flock	% farms	% birds	% farms	% birds	% farms	% birds	% farms	% birds
1-1999	41.0	10.0	27.4	3.6	25.7	2.1	19.6	1.2
2,000-4,999	37.0	27.0	32.5	12.6	19.5	5.9	18.7	5.2
5,000-9,999	15.0	24.3	21.9	18.4	28.1	18.4	29.3	17.6
10,000-29,999	6.1	22.0	14.6	28.5	21.3	31.2	26.2	35.8
30,000-49,999	0.6	5.0	2.3	10.4	2.9	10.2	3.6	10.9
More than 50,000	0.3	11.7	1.3	26.5	2.5	32.2	2.6	29.3

farms are demonstrated in Table 4. The average cost of producing 10 kg of eggs on small farms was US$ 10.617, while costs on industrialized farms were US$0.997 lower. A large part of the production costs, including the price of chicks and feed, can be reduced through the enlargement of farm size. This situation promoted the development of cooperatives. Following the success of a single cooperative which began in 1989, the Rural Development Administration established a total of 20 cooperative poultry farms in 1993.

The main purpose of establishing cooperative farms was to improve productivity and reduce production costs by improved management. The principle of cooperative farms is to combine individual farms together and improve efficiency. Organizing farms into cooperatives brought about a 9.2% increase in their egg production, a 6% decrease in feed consumption, an 8% decrease in production costs, and an 85% increase in the number of birds managed per person (Table 5). Cooperative farm management was 40% more efficient than individual farm management, mainly a result of improved laying performance, reduced mortality and lower management costs (Table 6).

Cooperative farms can supply chickens for a price 9% lower than the general market price. They can also take advantage of the better sanitation possible on a larger farm, and use modern farm facilities.

BROILER INDUSTRY

The broiler industry in Korea has been commercially developed since the 1960's, when specialized broiler breeds and feedstuffs began to be imported. At this time there was also an increase in the demand for broiler meat.

During the 1970's, however, there was often an imbalance in the supply of broiler products compared to the demand. This resulted in fluctuating market prices for live birds, giving farmers unstable incomes. Due to the general nature of broiler production, farmers tend to place orders for chicks based

Table 4. Production costs of 10 kg eggs according to farm size, Korea 1992

Unit: US cents

Cost item	Flock size (no. birds)				% total costs
	Less than 5000	5000-15,000	More than 15,000	Av.	
Chicks	286.1	276.5	262.4	268.1	22.3
Feed	681.0	671.7	670.9	671.8	55.8
Water, power & fuel	9.0	8.4	6.9	7.8	0.6
Veterinary services	5.9	7.0	10.5	8.8	0.7
Repairs	2.1	3.1	3.5	3.3	0.3
Small implements	0.6	0.5	0.5	0.5	0.0
Other materials	2.6	2.4	1.8	2.1	0.2
Hired labor	14.8	41.0	45.7	41.4	3.4
Interest on borrowed capital	1.4	2.1	2.3	2.1	0.2
Misc.	10.3	9.8	9.5	9.6	0.8
Depreciation	(38.6)	(33.6)	(30.9)	(32.6)	(2.7)
Building	20.9	18.6	16.4	17.7	1.5
Larger facilities	17.8	15.0	14.5	14.9	1.2
Sub-total cost	1052.5	1056.1	1044.9	1048.1	87.2
Family labor	156.9	97.3	77.8	92.6	7.7
Fixed labor	30.1	27.3	24.3	26.1	2.2
Liquid capital interest	31.1	30.1	28.6	29.3	2.4
Land capital interest	7.1	6.6	6.4	6.5	0.5
Total cost (A)	1277.7	1217.4	1182.0	1202.6	100.0
By-products (B)	137.8	140.6	141.8	140.9	-
Production costs (A-B)	1139.9	1076.8	1040.2	1061.7	-

Source: Korean Society of Poultry Science 1993

Table 5. Efficiency of cooperative farm management

	Before (1989)	After (1991)	Effect
Laying performance (no. eggs/yr)	262	286	9.2% increase
Feed (g/head/day)	126	118	6% decrease
Egg production cost (cents/dozen)	69.2	63.9	85% increase
No. of head managed/person	4,691	8,673	85% increase

Table 6. Relative efficiency of cooperative and individual farm management (per 10,000 laying hens)

Unit: US$

	Gross receipts	Operating costs	Production costs	Income	Net income
Cooperative management (A)	1,930.38	1,566.50	1,740.00	363.88	190.38
Individual management (B)	1,585.12	1,598.12	1,780.37	260.00	77.75
Difference (A-B)	72.26	31.62	40.37	103.88	112.63
Rate (%)	3.9	2.0	2.3	40	145

Table 7. Size of broiler farms and flocks in Korea after 1980

	1981		1985		1990		1992	
Size of flock	% farms	% birds	% farms	% birds	% farms	% birds	% farms	% birds
1 1999	32.89	9.74	22.46	5.51	15.53	1.39	20.74	1.11
2,000 4,999	45.16	37.61	44.41	28.86	22.67	9.84	14.01	4.53
5,000 9,999	17.04	30.53	24.49	34.41	31.89	27.83	22.02	15.53
10,000 29,999	4.56	17.83	8.39	24.92	28.19	51.88	39.17	62.10
30,000 49,999	0.33	3.06	0.48	3.67	1.41	6.42	3.26	11.63
More than 50,000	0.03	1.23	0.10	2.15	0.31	2.63	0.79	5.08

on the current price for broilers, which makes the supply uncertain. These fluctuations were increased by the fact that dressing, distribution and supply to fast food outlets was not well organized. Prices for broilers could double in a month, or fall by half within a few weeks.

Because the number of farms is changing rapidly, it is not easy to show the number of broiler farms and birds. Table 7 shows statistics taken in December. The number of farms gradually decreased, while small commercial broiler farms disappeared, and farms supplying broiler chicks became larger.

The production cost of broilers per 10 kg live weight was about US$11 (Table 8). Chicks and feed were 19.2% and 55.7%, respectively, of total production costs. The broiler industry cooperated with hatcheries and the feed industry, as well as the processing industry.

Integrated Production in the Broiler Industry

The best way to survive in today's highly competitive environment is to lower production costs, increase productivity, improve the quality of products and develop consumer services. These needs naturally led to greater integration from the late 1980s. By 1992, a total of 16 integrated concerns had been

Table 8. Production costs of broilers per 10 kg live weight in 1991

Unit: US cents

Item	Flock size (no. of birds) Less than 5,000	5,000-15,000	15,000 or more	Average	% Total costs
Chicks	228.1	239.0	246.9	241.3	19.2
Feed	749.4	715.7	670.0	698.1	55.7
Water, power & fuel	31.2	19.7	18.8	20.9	1.7
Veterinary services	37.7	35.9	23.6	30.1	2.4
Repairs	5.5	5.4	5.3	5.4	0.4
Small implements	2.3	1.4	1.1	1.4	0.1
Other materials	5.4	4.9	4.1	4.6	0.4
Hired labor	16.5	24.1	33.8	27.7	2.2
Interest on borrowed capital	0.5	1.0	1.2	1.1	0.1
Misc.	18.4	20.5	14.0	17.0	1.4
Depreciation	(30.9)	(24.3)	(20.4)	(23.3)	(1.8)
Buildings	16.1	15.3	13.3	14.4	1.1
Larger facilities	14.8	9.0	7.1	8.9	0.7
Sub-total cost	1129.8	1096.3	1043.9	1075.4	85.8
Family labor	192.8	117.8	178.3	150.6	12.0
Fixed labor	21.4	13.6	14.0	14.8	1.2
Liquid capital interest	8.8	8.1	8.5	0.7	2.4
Land capital interest	4.2	3.6	3.9	3.9	0.3
Total cost (A)	1357.0	1187.0	1301.0	100.0	100.0
By-products (B)	9.9	2.4	8.6	5.6	
Production cost (A-B)	1347.1	1184.6	1292.4	1247.5	

Source: Report of Livestock Production Cost Survey, 1992

Table 9. Cost of integrated broiler production compared to non-integration

Unit: US$

	Integration	Non-integration	Savings (%)
Live birds, per 1.5 kg	1.51	1.84	17.4
Dressed chicken, 1.0 kg	1.82	2.41	24.5
Cooked chicken, 1.0 kg	2.78	4.08	31.9

Source: Surveyed in 1990 by an independent researcher

Table 10. Live body and carcass weights of Korean native chicken

Age (weeks)	Sex	Live body weight	Dressed carcass weight	Eviscerated carcass weight	Carcass yield
9	M	652.7 g	589.5 g	487.8 g	90.4
	F	500.5	449.6	369.8	89.8
10	M	656.2	596.7	486.5	90.9
	F	598.3	537.6	442.2	89.9
12	M	944.7	850.9	713.7	90.1
	F	708.8	635.9	524.2	89.7
13	M	937.4	834.0	-	89.0
	F	788.4	708.3	-	89.8
14	M	924.6	879.9	740.0	93.4
	F	851.5	760.3	659.5	89.3

Table 11. Body chemical composition of the Korean native chicken

Body part	Breed	Sex	Moisture (%)	Crude protein (%)	Ether extract (%)	Crude ash (%)
Breast	Korean native chicken	M	69.00	26.30	3.66	1.25
		F	70.33	25.03	3.71	1.16
	Broiler	M	69.20	22.92	7.53	1.10
		F	65.34	26.34	5.90	1.34
Thigh	Korean native chicken	M	70.51	21.85	5.93	1.09
		F	70.45	21.65	6.90	1.10
	Broiler	M	66.88	22.04	11.20	1.07
		F	64.28	20.11	15.99	0.98

established, producing more than 30% of Korea's total chicken meat. According to a study of comparative cost efficiency, integration gave a price reduction of 32% for ready-to-eat chicken (Table 9).

Other Branches of the Poultry Industry

Several poultry farms in Korea are raising Korean Native Chickens, or the Ogol Fowl. The Korean Native Chicken is believed to have been raised for almost 2,000 years. It is not easy to find pure lines, because most disappeared during World War II and the Korean War. The remainder were crossed with imported breeds. Recently, many researchers have tried to find the specific characters of this breed. The Ogol chicken is bred, not for quantity, but for quality. The native chicken grows very slowly and its egg production is poor. The price of its meat is almost five times higher than that of ordinary broilers. The Korean native chicken was not bred for meat purposes, but is adapted to backyard raising. The boom to raise this breed started after consumers began to look for good quality chicken meat.

The average body weight of the Korean Native Chicken at 14 weeks of age is 867.7 g (Table 10). The eviscerated carcass yield at

9-14 weeks is 74.1-78.5% for males and 73.9-77.5% for females.

In terms of body chemical composition at 14 weeks, the crude protein of Korean native chickens was 25.03-26.36% in the breast and 21.65-21.85% in the thigh, which is a little higher than the crude protein content of broilers (Table 11).

The Korea Ogol fowl typically has black feathers, beak, comb, legs, bone, skin, and meat. The meat is often eaten as a folk remedy, to improve people's health. Although the meat of this breed fetches a very good price, it is not yet very popular. However, raising these two native breeds might be suitable for farmers who have only a small land area and limited resources.

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(Chinese Abstract) 摘　　要

台灣的家禽事業包括雞（蛋雞、肉雞、土雞）、鴨和鵝的生產，在台灣農業上擔任一個相當重要的角色。新品種的引入及新的生產技術的導入使台灣家禽生產從1950年代傳統式生產發展成爲1980年代商業式的生產。在1992年整個生產總值爲美金13億美金，僅次於豬和水稻生產位列第三。

本文主要探討台灣家禽事業的發展，新的加工產品，特別是土雞育種生產和不同家禽研究機構及他們的作用。

(Japanese Abstract) 摘　　要

台湾の家禽産業とは、にわとり（産卵鶏、ブロイラー、地鶏）、あひる、がちょうの飼育で、農業の重要な一翼をになっている。新系統や先進的な技術の導入で、1950年には庭先産業に過ぎなかった家禽飼育も、1980年には事業的規模にまで拡大した。1992年には総生産高は13億ドルに達し養豚、米作につぐ第3の農業生産物になっている。

ここでは台湾における家禽産業の発展の跡をたどるとともに、新加工製品や特産の台湾固有系統の紹介、家禽関係の各種の機関とその役割について紹介したい。

(Korean Abstract) 초　　록

대만의 가금업은 양계, 육계, 토종닭의 닭사육업은 물론 오리, 거위까지 포함되어 농업생산의 중요한 부분을 차지하고 있다. 1950년대 까지는 농가소비정도의 소규모로 사육되어었으나 1980년대 이후로는 전업가금업형태로 전환되었다. 종자개량과 선진기술의 도입과 함께 생산량도 늘어 1992년 가치 총생산량은 미화 13억불에 이름으로써 양돈및 쌀생산에 이어 3위의 주요작물로 기록되었다. 이글은 또한 가금의 재래종개발, 가공제품생산, 그리고 여러 가금 관련협회에 대해서도 소개하였다.

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ABSTRACT

The poultry industry of Taiwan includes the raising of chickens (layers, broilers, and native chickens), ducks, and geese. It plays an important role in the agriculture of Taiwan. The introduction of new breeds and advanced production techniques has developed Taiwan's poultry industry from the backyard enterprise it was in 1950, to a major business in 1980. The total production value in 1992 was US$1.3 billion. It ranked third after hog production and rice in total agricultural production.

This paper reviews the development of the poultry industry in Taiwan, the introduction of new processed products, the production of special native poultry breeds, and various poultry organizations and their functions.

DEVELOPMENT OF TAIWAN'S CHICKEN INDUSTRY

From 1940 to 1980, chicken raising in Taiwan was only a sideline business. Raisers had a small number of chickens in their backyards. Generally, the feed had very simple ingredients such as broken rice, rice bran, fish bone meal, and soybean. During this period, the government tried very hard to promote the chicken industry. Demonstration type chicken farms were established in all prefectures under the guidance of the Provincial Department of Agriculture and Forestry. A cock replacement project was sponsored by the Joint Commission on Rural Reconstruction (JCRR). This aimed to replace native cocks with exotic lines to improve the body size and growth rate of chickens. JCRR also subsidized the Taiwan Farmers' Association to establish feed factories to supply chicken farms' needs.

Because of the good performance of the Hyline laying breed, poultry farmers were eager to introduce exotic chicken breeds from 1960 to 1970. Many people tried every possible method to become an authorized agent for Taiwan poultry farms. Chickens were sold with the original foreign breed trade mark. Since then, poultry farmers have depended more on foreign breeds and techniques, and most technical seminars have been conducted by foreign specialists. After 20 years of rapid development, the poultry

Keywords: Down industry, duck eggs, duck meat, eggs, geese, Kaiya duck, native chicken, poultry, poultry meat, Taiwan, Tsaiya duck

Table 1. Poultry production in Taiwan (1,000 birds).*

Unit: 1u00 birds

Year	Layers	Broilers		Tsaiya (Layer ducks)	Mule-ducks (Broiler duck)		Geese		Turkeys	
	(1)	(1)	(2)	(1)	(1)	(2)	(1)	(2)	(1)	(2)
1965	-	-	-	-	-	1,541	-	410	-	
1970	3,058	11,764	-	-		-	1,484	2,969	546	1093
1975	6,272	18,848	52,337	2,646	5,070	16,876	1,335	2,697	675	1314
1980	11,739	29,655	96,971	2,590	7,338	25,850	1,399	2,855	675	1381
1985	20,016	39,287	140,691	2,241	7,997	30,279	1,546	3,186	558	1163
1990	22,389	54,159	210,079	2,199	8,425	38,269	1,850	4,777	349	758
1991	23,005	55,828	218,196	2,198	8,463	34,739	1,931	4,628	284	636
1992	23,961	63,457	241,078	2,656	12,063	38,793	2,305	5,683	267	543
1993	24,300	64,500	245,000	2,800	10,400	41,000	2,700	6,500	261	530

* Taiwan Agriculture Year Book 1992 Provincial Department of Agriculture and Forestry

Remarks: (1) No. at the end of the year
(2) No. slaughtered each year

market became a saturated market in 1980.

Poultry farms became more competitive in their marketing. Only farms with better breeds and good social contacts survived, while losers closed down.

Since 1980 up to the present, poultry production efficiency has greatly increased. There were 41.39 million chickens raised in 1980, and 87.42 million in 1992, an increase of 111% (Table 1). Total production values from the poultry sector in 1980 and 1992 were US$0.68 and 1.3 billion, respectively. These represented 10.96% and 34.55% of the total value of animal production. Poultry production value ranked third after hogs and rice production, and became a major item in agricultural production. At present, breeds for eggs and white meat production are imported, whereas breeding stocks and colored meat-type chickens are bred locally.

EGG PRODUCTION

Eggs are an important daily food in Taiwan. Egg production has increased rapidly over the past ten years (Table 2). More than 4.7 billion eggs were produced in 1992, with a total value of US$294.6 million, accounting for 3.0% of the total value of agricultural production. Egg production is an important agricultural enterprise in Taiwan's central and southern regions.

MEAT PRODUCTION

Both feed ingredients and broiler breeds are imported. The production costs are higher than in United States, Thailand, or Brazil, so that exportation is impossible and prices are unstable. The fast-moving industrialization of Taiwan has led to a rapid increase in the number of fast-food stores and supermarkets. Dietary preferences in Taiwan have shifted to pork and beef, and sea food, rather than poultry meat. The growth in poultry meat production between 1982 and 1992 is shown in Table 3.

POULTRY PROCESSING AND NEW PRODUCTS

In 1992, 25.7 million chickens were slaughtered. These included 15.0 million chickens. Of these, 58% were slaughtered at 13 modern slaughterhouses. Since the number of modern slaughterhouses is increasing, it is becoming easier to purchase sanitary chickens. In addition, local people are now beginning to realize that chicken meat has less fat than beef or pork. Poultry meat consumption is increasing, and various types of processed chicken are now available.

Research on Poultry Meat Ingredients

About 10% of the chickens slaughtered each year are spent layers. Their meat is tough and not very palatable, and their price is low. Research into making better use of this resource covers the following topics.

- Percentage of meat in carcasses of culled layers and broilers;
- Comparison of chemical composition and other characteristics of the meat of culled layers and broilers;
- Chemical composition of mechanically deboned meat;
- Sanitary standards of mechanically deboned meat.

Development of Poultry Meat Products

The development of processed poultry meat products comes from market demand for novelty foods.

- Emulsion products: meat loaf, hot dogs, meatballs
- Other products: meat sticks, ham, chicken nuggets, patties made of reconstituted meat, duck steaks.

PRODUCTION OF NATIVE POULTRY BREEDS

Native Chicken

The native chicken is selected and bred by local people. There are now 1,400 native chicken farms, and production is increasing every year (Table 4).

The general characteristics of a native chicken include the following:

- Single comb, black and gray shank
- Inferior growth rate and feed efficiency (3.03 kg feed for 1 kg gain at 14 weeks of age)

Table 2. Growth in egg production, 1981-1992

Year	Egg production (1000 eggs)	Growth index (%)
1981	2,048,760	100
1985	3,344,729	163
1990	4,032,185	197
1992	4,754,761	232

Table 3. Growth in meat production, 1982-1992

Year	Number of broilers (1000 birds)	Carcass weight (mt)	Growth index (%)
1982	122,353	216,202	100
1985	154,686	271,786	126
1990	226,556	383,118	177
1992	257,666	434,068	201

Table 4. Meat production and growth index of colorful broiler since 1983[a]

Year	No. of broilers (1000 birds)	Carcass weight (mt)	Growth index (%)
1983	97,567	175,325	100
1984	102,079	184,272	105
1985	101,151	184,280	105
1986	100,023	184,246	103
1987	114,590	206,966	118
1988	119 424	212,720	121
1989	130,410	228,764	130
1990	135,664	231,058	132
1991	126,692	214,083	122
1992	136,831	262,716	150

a Annual Report of Taiwan Agriculture 1992

Table 5. Duck production in Taiwan, 1975-1992

Unit: 1000 birds

Year	Tsaiya[a] (layer)	Mule[a] (meat)	Mule[b] (meat)
1975	2,646	5,070	16,876
1980	2,590	7,338	25,850
1985	2,214	7,997	20,279
1990	2,199	8,425	38,269
1992	2,656	12,063	38,794

a Number at the end of the year
b Ducks slaughtered

- Wide range of body size
- Active, lively, and fond of fighting
- Good eggshell quality, big yolk ratio, but poor laying ability
- Early maturing, delicious meat, a great favorite among Taiwan consumers.

Stocks of Taiwan native chicken were first bred and improved during the early 1980's. In 1985, the Taiwan Livestock Research Institute (TLRI) collected native chickens and bred these by full-sib mating to unify their characteristics and establish inbreeding lines. These inbreeding lines were further crossed with other lines, and their growth and reproduction performances were tested before they were extended to farmers. There are now four inbreeding lines with the following traits:

1. Age at 1st egg, 151-157 days
   Body weight at age of 1st egg, 1,650-1,994 g
   40-week body weight, 1,794-2,033 g
   40-week egg number, 60-70 eggs
   40-week egg weight, 45-47 g

2. Body weigh t 8 weeks, 725.5 and 619.9 g
   12 weeks, 1327.4 and 1052.0 g
   16 weeks, 1855.6 and 1448.4 g

THE DUCK INDUSTRY

Ducks are traditional poultry in Taiwan, and play an important role in the village economy. According to the Taiwan Agriculture Yearbook, the number of mule ducks slaughtered in 1992 was 38.79 million (Table 5), which ranks tenth in terms of total production value.

The per capita consumption per year is 1.6 ducks. The export of duck meat to Japan has been increasing gradually in recent years. More than 5,096 mt of frozen and chilled duck meat was exported in 1992, with a value of US$23.8 million. The quality and taste of duck meat is very important to Chinese and Japanese consumers. There is a distinct Oriental style of breeds, management, slaughtering, cooking, and consumption. Some 400 million duck eggs are produced each year. These are used mainly for "thousand-year eggs" (preserved eggs) or salted eggs (Table 6).

As a result of successful selection of ducks with white plumage and down, the value of down has increased tremendously and the down industry has developed rapidly, making Taiwan a world center for this product. The production value of the down industry was US$0.17 billion, and it was third in terms of export value for primary agricultural products. In the Southeast Asian market, most of the partially incubated eggs are from Taiwan. In recent years, the number of such eggs exported from Taiwan declined due to competition from other countries such as Thailand, but there are still about 4.4 million eggs exported every year.

There are five types of duck production in Taiwan, namely, breeding farms, meat farms, layer farms, hatcheries, and dressing plants. Breeding farms usually keep only one breed of duck, Kaiya, Pekin, or Muscovy. The female Kaiya, a hybrid of male Pekin and female Tsaiya (see below), is mated with a Muscovy drake to produce mule ducks. The mule duck is the major meat duck in Taiwan, because of its excellent flavor (Fig. 2).

Kaiya breeding farms produce mule ducks for the domestic market. Artificial insemination is widely used, but labor-consuming. The average size of Kaiya farm is smaller than other types of farm, with 3,000 to 8,000 birds. Farms raising ducks for meat generally keep only one duck breed. Mule ducks are produced for the domestic market. Half of the farms are run according to a duck/fish integrated farming system. Farms which raise Pekin meat ducks for export all have contracts with food processing companies for production and marketing. Most Pekin duck farms have more than 10,000 ducks. Muscovy duck meat is used for the domestic market. After the Mid-Autumn Festival each year, the consumption of Muscovy meat, which is cooked with special Chinese herbs, goes up tremendously. From 5 to 6 million birds are consumed in Taiwan each year.

The major laying duck in Taiwan is the Brown Tsaiya. The size of laying duck farms varies from 1,000 to 60,000 birds per farm. Some breeder farms operate hatcheries, providing ducklings for the local market and half incubated eggs for export. There are five dressing plants which export to Japan and two which supply the local market. Dressing

Table 6. Quantity and value of duck production in Taiwan

Items	1991		1992	
	Quantity	Value (US$)	Quantity	Value (US$)
Laying ducks (1000 mt)	1,680	1,220,392	1,906	1,729,411
Meat ducks (1000 mt)	62,530	128,329,960	69,827	122,923,725
Duck eggs (1000)	393,937	30,124,588	391,648	29,949,568
Laying ducks (1000 birds)	1,556	65,822	1,764	74,745
Meat ducks (1000 birds)	34,739	2,452,156	38,794	2,738,313
Exported				
Feathers (1000 mt)	10,595	145,048,000 (3,58%)[a]	11,947	165,235,000 (4.18)[a]

a Percentage of feather export/agricultural export

plants should be automated, to maintain high standards of sanitation.

Feather processing is an important industry in Taiwan. Local dressing plants process 40% of the raw down requirements, while the other 60% is imported and processed for export. The feather industry is a major foreign exchange earner in Taiwan.

Most duck meat eaten in Taiwan is in a conventional form such as roasted or dried duck. However, some products are for export, e.g., duck meat strings, balls, ham, and smoked duck steak. New products should be developed to meet future consumption trends.

After more than 20 years, the Duck Research Center (DRC) of the Taiwan Livestock Research Institute is able to select and extend breeders to farms without any foreign help. DRC provides duck farmers with most of the breeders raised.

Consumers in Taiwan have strong preferences for quality and flavor which differ from those of Europeans and Americans. International trade should be more open. Duck raisers should promote production efficiency and environmental protection, enhance their global competitiveness, improve product sanitation, and develop a greater range of processed products. Listed below are the main research directions of DRC:

- Selection of white plumage grandparent stock lines with ideal reproductive and growth characters to produce mule ducks with pure white plumage.
- Selection of the Muscovy duck, which grows fast and lives on land. It is well suited to reducing water pollution in rivers. Muscovy meat contains less fat and has a delicious flavor.
- Adoption of a feeding system with low water consumption. Ducks can be reared in litter pens to prevent pollution.
- Well-planned duck production, with duck farmers organized into integrated production systems. Good raising techniques should be promoted, e.g. by issuing a licence. Private enterprises (processing plants, feed manufacturers) should be encouraged to cooperate with farmers. A certain number of farmers' cooperatives should be maintained.
- Quality control and good sanitation should be promoted. With changes in living styles, people now expect to consume products which are automatically dressed, cut, and packed into chilled fresh meat or ready-to-eat products.

GOOSE PRODUCTION

There are 1,850,000 geese raised each year for meat and feathers. In 1991, 4.63 million geese were slaughtered, with a value of US$65.2 million, representing 0.73% of total agricultural production value. Annual per capita consumption of goose meat is 0.92 kg. Although the goose industry is not very big, its growth rate is increasing each year. Over the past ten years, the number of geese slaughtered has increased by 70%. Most of the geese raised are White Roman and Chinese. White Roman geese represent 90% of the market because of their profitability. Generally, portions of cooked goose are sold in restaurants, specialty stores, and night markets.

A SUCCESSFUL POULTRY-BASED ENTERPRISE

Although poultry production techniques are well developed in Taiwan, certain production and marketing deficiencies can be observed.

In meat production, price fluctuations are very common, for the following reasons. Firstly, the production cycle of chicken meat is very short; secondly, few farmers in the industry produce under contract; and thirdly, the price of chicken at poultry wholesale markets depends completely on the daily chicken supply.

Production size is too small (an average of 10,000-30,000 birds per farm). There is a high mortality rate among the birds, the result of trading in live birds. The marketing system is also complex.

In egg production, prices are unstable. Producers and buyers cannot negotiate for the price. Producers also lack control over the quantity produced because of wholesale marketing. Egg prices are not determined by quality, so farmers do not consider improving the raising facilities or timely culling of layers. Festivals affect the number of eggs consumed; surplus eggs from the holiday period are not used, and this lowers egg prices. The industry is not yet completely upgraded. Practices such as egg treatment, transportation, marketing, and processing are still rather backward. Various programs have been tried to improve these deficiencies. Today, the situation is much better, although many improvements have still to be made.

Producers should organize themselves, so that their organizations can address their problems. Businessmen should share the profits and risks.

To assist organizations such as the Poultry Association, the Cooperative Taiwan Development Foundation, and farmer's cooperatives, the following steps are recommended.

Poultry Associations

Chicken farmers are already organized into the Poultry Association. They should have representatives to present their strategies concerning production and marketing. The Association should assist the Cooperative Taiwan Development Foundation and farmers' cooperatives to implement policy on production and marketing.

Cooperative Taiwan Development Foundation

The foundation should evaluate the suggestions of the Poultry Association. It should also provide the capital needed to stabilize the prices of poultry meat and eggs.

Cooperative Meat and Egg Production

Cooperatives should be responsible for production and selling, and should provide information on prices to rural farms. The cooperative should control the buying of surplus products and the culling of older layers, as directed by the Poultry Association and Cooperative Taiwan Development Foundation.

Organization of Layer Farmers

About 1,500 layer farms have been organized. There are 100 layer farm divisions and 15 committees, based on geographical area. All groups are directed by the Poultry Association. These should be able to provide information on production and prices to the Poultry Association for analysis, evaluation and publication. Farmers could then adjust the production quantity according to the data published.

Organization of Broiler Farmers

About 3,000 farms which produce broilers and native chickens have been organized into 250 divisions under 25 committees. All groups are directed by the Poultry Association. Transportation and distribution of chickens and carcasses to the three Broiler Marketing Cooperatives are facilitated. The Association offers production and marketing information to its members.

To improve the production and marketing system, the following are recommended:

Meat Chickens

A committee of farmers should be established under the Poultry Association to negotiate chicken prices. This committee should also control the chicken supply, and prevent the wholesale market from controlling the price. Chicken farmers should negotiate quantities and prices with the cooperatives. The cooperatives should then negotiate with dealers who negotiate with retailers.

Contract farming by arrangement with cooperatives or private slaughterhouses should be encouraged. The establishment of cold chain channels and branded products should also be promoted.

Layers

Around 10-20 egg collecting and packaging stations in the vicinity of laying farms should be set up in Taiwan. Egg prices should be based on quality. Egg processing plants making products such as liquid eggs and egg powder should be established.

SOME POULTRY ORGANIZATIONS AND FUNCTIONS

Some of the poultry organizations so far established in Taiwan are as follows:

The World's Poultry Science Association, Taiwan Branch

Poultry Association of R.O.C.	Breeder Broiler Division, Broiler Division, Native Chicken Layers Laying Breeder Hen Division, Grower Laying Hen Division, Laying Hen Division Electric slaughter: Chicken Electric Slaughter Division
Taiwan Chicken Products Cooperatives	Chicken Products Assembly Location Wholesale Distributor Supermarkets Processing Plants
Duck Association of R.O.C.	Laying Duck Division, Meat Duck Division, Muscovy Duck Division, Breeder Muscovy Duck Division
Goose Association of Taiwan	
Taiwan Commercial Hatcheries Guild	
Cooperative Taiwan Development Foundation	Chicken Product Extension Council Chicken Division, Water Fowl Division Egg Product Division

Cooperatives

Taiwan Chicken Egg Marketing Cooperative
Northern Taiwan Broiler Marketing Cooperative
Central Taiwan Broiler Marketing Cooperative
Southern Taiwan Broiler Marketing Cooperative
Kaohsiung County Duck Cooperative

These organizations have helped farmers produce more at a lower cost, and to market their products at a reasonable price. These organizations have done well in past years. When there was a surplus of poultry products and prices dropped, these organizations exported, processed or stored this surplus to maintain a reasonable price for farmers. The stored poultry products were marketed when prices went up.

These organizations should take more responsibility in developing the poultry industry of Taiwan, working closely with poultry farmers.

FUTURE DEVELOPMENTS

Chicken meat and egg consumption in Taiwan continues to increase as the national economy grows. The poultry industry can be expanded even further, to include automation, and the development of processing for product variety. Both chicken and duck production should respond to the cooperative movement. Bilateral vertical integration with private companies should be promoted.

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DISCUSSION

Director Koh of FFTC pointed out that the collection and conservation of genetic resources of poultry and livestock is very important for future development. He asked what is being done in Taiwan in this regard, and also what measures are being taken to stabilize the prices of eggs and poultry meat. Dr. Wang replied that the ROC government had established a gene conservation project five years previously which included both livestock and poultry. He commented that the project was begun too late, but at least steps are now being taken to conserve traditional breeds and genotypes.

With regard to price fluctuations, Dr. Wang described a extension and training program which had begun three years earlier to study price stabilization for poultry meat and eggs. An important recommendation from this program was the promotion of poultry producers' cooperatives. If producers are organized, it is much easier to keep them informed about market demand and prices, and this should help stabilize the price of poultry products. Dr. Argañosa asked what would be the ideal feed efficiency of white mule ducks for these to be economically viable. Dr. Wang replied that in considering profits from mule ducks, resistance to disease and carcass quality must be taken into account, as well as feed efficiency. In Taiwan, the meat of mule ducks is considered superior to Pekin duck, but not as good as Muscovy. About three kilograms of feed is needed to produce a kilogram of mule duck meat, and production on this basis is profitable in Taiwan.